REMARKS

Reconsideration and allowance of this application are respectfully requested. Claims 18, 37-70 and 74-76 are cancelled. Claims 1-17, 19-36, and 71-73 remain in this application and, as amended herein, are submitted for the Examiner's reconsideration.

In the Office Action, claims 1-2 and 4-14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakamura (U.S. Patent Application Publication No. 2003/0010993) in view of Parikh (International Publication No. WO 03/026021). Applicants submit that the claims are patentably distinguishable over the cited references.

In a Schottky diode, a *very low doped layer* is desired for the metal-to-semiconductor contact to optimize the Schottky diode for both high reverse-bias breakdown voltage and low forward bias on-resistance. Such low doping levels, however, are very difficult to attain in a manner that is both repeatable and uniform across the layer using known methods.

The present invention addresses this problem by providing a modulation doped layer structure formed of at least one sub-layer of doped nitride semiconductor and at least one sub-layer of undoped nitride semiconductor such that the resulting modulation doped layer structure has an overall doping concentration of at most 2E16 cm^{-3}.

Claim 1, for example, defines a method of forming a semiconductor layer structure, which includes:

> forming a modulation doped layer structure atop at least a portion of another layer by forming at least one sub-layer of doped nitride semiconductor and at least one sub-layer of undoped nitride semiconductor atop the at least portion of said another layer such that *the resulting modulation doped layer structure has an overall doping concentration of at most 2E16 cm^{-3}*. (Emphasis added.)

The Examiner acknowledges that "Nakamura does not

explicitly state that the modulation-doped layer has a concentration of at most 2E16cm^{-3}." In fact, Nakamura discloses a structure whose overall doping concentration is *more than two orders of magnitude greater* than that of the modulation doped layer structure defined in claim 1. Nakamura describes pairs of layers in which each pair is formed of (i) an undoped GaN layer having a thickness of 20 angstroms, and (ii) a doped GaN layer having a thickness of 20 angstroms and a doping concentration of 1×10^{19} cm^{-3}. (See ¶ [0054]). The resulting pair of layers has an overall doping concentration of 0.5×10^{19} cm^{-3}, namely, *an overall doping concentration of 5E18 cm^{-3}*.

Moreover, Nakamura provides no motivation to one of ordinary skill in the relevant art for forming a modulation doped layer structure *to attain a lower overall doping concentration*, such as such as an overall doping concentration of *at most 2E16 cm^{-3}*. Rather, Nakamura is concerned with increasing the carrier concentration of a nitride semiconductor layer, i.e., *increasing the overall doping concentration* of the nitride semiconductor layer, without also causing the deterioration in the crystallinity of the layer that typically results from such increased doping concentrations. Nakamura therefore teaches a laminated structure of doped and undoped GaN layers to meet these goals. (See, e.g., ¶¶ [0011]-[0013], [0021] and [0029].) Nakamura does not disclose or suggest that there is a similar need to improve the crystallinity *of a lower doping concentration layer*, and Nakamura, in fact, does not address any of the problems associated with such lower doping concentrations, such as attaining the lower doping concentration in a manner that is both repeatable and uniform across a layer.

Nevertheless, the Examiner contends that "it would have been obvious … to adjust the modulation doped layer concentration as taught by Parikh in the process of Nakamura in order to form a high quality film with improved crystallinity."

However, obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention *where there is some teaching, suggestion, or motivation to do so* found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. (See MPEP § 2143.01.) Though Nakamura addresses the problem of attaining improved crystallinity *at higher doping concentrations*, neither Nakamura nor Parikh discloses or suggests that such improvement in crystallinity is similarly needed (or otherwise desired) *at lower doping concentrations*. Moreover, neither Nakamura nor Parikh provides any other teaching or motivation for combining the teachings of Nakamura and Parikh in the manner asserted by the Examiner.

The Examiner further argues that "parameters such as concentration in the art of semiconductor manufacturing process are subject to routine experimentation and optimization to achieve the desired device characteristics during fabrication", and the Examiner concludes that "it would have been obvious … to adjust the modulation doped layer concentration as claimed in the process of Nakamura in order to form a high quality film with improved crystallinity." However, as pointed out above, neither Nakamura nor Parikh provides any indication or suggestion that an improvement in the crystallinity is either needed or desired at lower doping concentrations. Moreover, "adjusting" the value of a parameter is characterized as "routine experimentation" *only when* the particular parameter is first recognized as a result-effective variable, i.e., *as a variable which achieves a recognized result*. (See MPEP § 2144.05 citing *In re Antonie*, 559 F.2d 618 (CCPA 1977) and *In re Boesch*, 617 F.2d 215 (CCPA 1970)). Here, neither Nakamura nor Parikh discloses or suggests that attaining a low doping level in a manner that is both repeatable and uniform across the

layer is a recognized result of forming a modulation doped layer structure having an overall doping concentration of at most 2E16 cm^{-3}. Hence, a modulation doped layer structure having an overall doping concentration of at most 2E16 cm^{-3} cannot be considered the result of "routine experimentation".

It follows that claim 1 is patentably distinct and unobvious over the cited references.

Claims 2 and 4-14 depend from claim 1. Therefore, each of claims 2 and 4-14 is patentably distinguishable over the cited art for at least the same reasons.

The Examiner also rejected claim 3 under 35 U.S.C. § 103(a) as being unpatentable over Nakamura and Parikh in view of D'Evelyn (U.S. Patent Application Publication No. US 2002/0155634 A1) and rejected claims 15 and 16 under 35 U.S.C. § 103(a) as being unpatentable over Nakamura and Parikh in view of Lee (U.S. Patent Application Publication No. US 2001/0034116 A1).

Claims 3, 15 and 16 depend from claim 1 and are therefore distinguishable over Nakamura and Parikh for at least the same reasons. For the reasons set out in the January 31, 2006 Amendment, neither D'Evelyn nor Lee remedies these deficiencies.

Claims 17 and 19-35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakamura and D'Evelyn in view of Parikh.

Independent claim 17 has been amended to incorporate limitations similar to those recited in claim 1. Therefore, claim 17 is distinguishable over Nakamura and Parikh for at least the same reasons. As noted above, D'Evelyn does not address these deficiencies. Also, claim 17 is further distinguishable over the cited references for the reasons described in the January 31, 2006 Amendment.

Claims 19-35 depend from claim 17 and are distinguishable over the cited art for at least the same reasons.

Claims 71-73 were rejected under 35 U.S.C. § 103(a) as being unpatentable over "Nakamura, D'Evelyn, Parikh in view of Nakamura". Claim 71 has been amended to incorporate limitations similar to those recited in claim 1 and is therefore distinguishable over Nakamura and Parikh for at least the same reasons. Also, as pointed out above, D'Evelyn does not address these deficiencies. Claim 71 is further distinguishable over the cited references for the reasons described in the January 31, 2006 Amendment.

Claims 72-73 depend from claim 71. For at least the same reasons, claim 72-73 are distinguishable over the cited art.

Finally, claim 36 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakamura, D'Evelyn, Parikh in view of Sheu (U.S. Patent No. 6,712,478). Claim 36 depends from claim 17, and therefore claim 36 is distinguishable over Nakamura, D'Evelyn and Parikh for at least the same reasons. As described in the January 31, 2006 Amendment, Sheu does not remedy the deficiencies of D'Evelyn and Parikh.

Accordingly, Applicants respectfully request the withdrawal of the rejections under 35 U.S.C. § 103(a).

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue. If, however, for any reason the Examiner does not believe that such action can be taken at this time, it is respectfully requested that the Examiner telephone applicant's attorney at (908) 654-5000 in

order to overcome any additional objections which the Examiner might have.

If there are any additional charges in connection with this requested amendment, the Examiner is authorized to charge Deposit Account No. 12-1095 therefor.

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Respectfully submitted,

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